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# 2 Road and Upland Management Commitments

**The Commitments**

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Plum Creek requires the use of roads to conduct forest management on its lands. Approximately 20,000 miles of forest roads occur on Plum Creek land in the Project Area (16,000 miles) or are access roads leading to Plum Creek land (4,000 miles) for which Plum Creek has either direct or shared responsibility. Also, Plum Creek expects to construct an estimated 1,300 miles of road during the 30-year term of the NFHCP for commercial forestry activities Most new roads will branch off existing road systems in already roaded landscapes.

Forest roads can impact fish because of the introduction of sediment to streams, thus impacting one of the Four C's (**C**lean). This happens when muddy water that runs off of roads is allowed to enter streams. It can also happen if a portion of a road fails and creates a landslide that enters a stream. When sediment is allowed to enter streams, it can impact fish by reducing the quality of the spawning gravel and/or reducing pool volume. Also, stream culverts that have not been properly installed or maintained can restrict the passage of fish, impacting another of the Four C's (**C**onnected). Older roads built immediately adjacent to streams may also affect the **C**omplexity of streams and their **C**old water.

## Sediment Delivery Reduction Strategies

The miles of road in a given area (density) can be used as a numerical indicator for a wide variety of human impacts that are difficult to measure directly. The Interior Columbia River Basin Ecosystem Management Project (Quigley and Arbelbide 1997) summarized the array of potential impacts from roads as follows:

> *Activities associated with roads include, but are not limited to, fishing, recreation, timber harvest, livestock grazing, and agriculture. Roads also provide avenues for stocking non-native fishes. Unfortunately, we do not have adequate broad-scale information on many of these attendant effects to identify their component contributions accurately. Thus we are forced to use roads as a catch-all indicator of human disturbance.*

While simply reducing the total length of roads in a given area could be a general strategy for reducing impacts associated with roads, the scientific literature (Plum Creek 1998a) demonstrates impacts of roads on streams are predominantly dependent upon the specific road location, design, construction, and maintenance practices. Using road density alone to discuss impacts to fish is done by some on a very broad and generalized scale, but it does not provide an accurate picture of where roads may be causing trouble for fish. Therefore, it is impractical for directing conservation investments where roads already exist and are required by the landowner.

**A Comparison of Road Density and Abundance of Spawning Bull Trout in the Swan River Basin, Montana**

Suitable information exists in the Swan River Basin to test the hypothesis that road density is a good indicator of high quality fish habitat. Montana Department of Fish, Wildlife, and Parks and Plum Creek have surveyed bull trout spawning "nests" in the Swan Valley for the past 17 years. In a detailed analysis of these data, road density was not found to be statistically correlated with either the number of redds, or the change in redd counts since 1982 (Plum Creek 1998h).

What was found to be statistically significant, however, was simply that spawning abundance was closely related to the amount of certain types of habitat available. No other data sets in the Project Area, other than the Swan Valley, are sufficient to test this hypothesis further. This analysis does not suggest that roads do not have the potential to negatively affect fish habitat in general, or bull trout habitat in particular. Rather, it leads to the conclusion that the ultimate effect of roads (such as road-related human uses) can be better addressed by evaluating the contribution and complications of those uses on native fish in individual watersheds rather than employing a simplistic "surrogate" such as road density.

Since Plum Creek's task in this NFHCP is to identify specific conservation actions, the chosen approach uses proven methods to isolate cause and effect mechanisms in specific circumstances instead of a generalized road density standard.

Because roads are essential for managing timberlands for commercial forestry, Plum Creek has taken a more specific look at the sources of road impacts and developed an approach to minimize and mitigate problems at their direct source. This approach allows Plum Creek to maintain a road system that is effective and efficient for forest management while reducing or eliminating impacts. Also, this approach is likely to provide more specific and effective conservation. This section primarily addresses the direct effects of sediment delivery to streams from roads caused by their use for commercial forestry. However, minimizing other non-forestry "related effects" is also addressed in this section (and elsewhere).

Plum Creek NFHCP Technical Report #3 *Surface Erosion and Mass Wasting Assessment and Management Strategies for Plum Creek's NFHCP* (Plum Creek 1998a) examines carefully the relationships between forest roads and the introduction of sediment to streams. It identifies specific situations where impacts from roads are the greatest and the actions that can be taken to reduce those impacts. Additionally, the Services have expressed general concerns associated with roads, such as the potential impact of roads on flow routing efficiency and the impacts associated with recreational use by the public.

The following package of road commitments focuses on specific conservation opportunities where there is the greatest confidence of success in reducing impacts to fish, and to balance those site specific commitments with programmatic ones that address the Services' more general concerns about roads. It is a comprehensive package that not only specifies the conservation measures to be implemented on the ground, but spells out a management system that will ensure effective implementation.

## Slope Stability Considerations

Landslide rates are generally much lower in the inland northwest than in coastal Washington and Oregon. In a review of watershed analyses conducted across the Project Area, McGreer et al. (Plum Creek 1998a) found Western Washington landslide rates were about 15 to 25 times higher than dry sites in Eastern Washington, and 50 times higher than in Western Montana. Landslide rates in Idaho (McClelland et al. 1997) are also lower than Western Washington.

Roads are often cited as the predominant cause of management-related landslides. Studies have consistently shown more than 90 percent of landslides related to forest management are associated with roads (Swanston and Swanson 1976; McClelland et al. 1997). Roads can contribute to instability by adding weight to the embankment fill, locally steepening the cut and fill slopes, removing support of the cut slope, and rerouting and concentrating drainage water (Sidle et al. 1985). Contemporary road construction and drainage practices address these vulnerabilities.

Timber harvesting can also reduce slope stability by reducing root strength in the soil and temporarily increasing soil moisture. As reviewed by McGreer et al. (Plum Creek 1998a), harvest-related landsliding is rare in the inland portion of the Project Area.

Slope stability is discussed within Montana, Idaho, and Montana forest practice rules in sections on timber harvest activities and road planning, location, design, construction, and maintenance. The rules for each of these states have similar wording. Many states adopt regulations or practices called “Best Management Practices” (BMPs) to minimize water quality impacts associated with forest practices. Montana BMPs relating to slope stability are summarized in Table NFHCP2-1.

In addition to the types of rules discussed in Table NFHCP2-1, the state of Washington screens all forest practices activities for the presence of high hazard landslide areas. If any are found, they are designated a “Class IV Special,” whereupon an agency and landowner inter-disciplinary team is formed, and site-specific management practices are developed to address any hazards identified.

The NFHCP strategy to address slope stability builds upon basic state regulations and, where necessary, supplements them with additional practices. Throughout the Project Area, the principal slope stability concerns center around four landforms: bedrock hollows, convergent headwalls, inner gorges, and the toes of deep-seated landslides. These landforms are defined in Appendix R-8. While these landforms primarily exist in Washington, they can exist in the inland portion of the Project Area (most usually inner gorge landforms). Because of their proximity to streams, these are high-risk areas that warrant careful consideration when locating new roads. NFHCP commitment R2, *New Road Construction* includes specific measures for dealing with these four landforms in Idaho and Montana. For Project Area activities in Washington, the NFHCP will utilize the Washington Forest Practice Rules slope stability requirements (For more detail, see Appendix Rp-6)

To address road stability risks associated with old legacy roads, the process specified in NFHCP Commitment R4, *Road Condition Inspections*, will identify where perched road fills exist and other areas where existing roads have a stability concern. Where identified, they will be addressed under R6, *Hot Spot Treatments*.

For the remainder of the Project Area, the NFHCP will rely on existing regulations, supplemented, however, in several areas outlined in NFHCP's *New Road Construction* commitment.

**TABLE NFHCP2-1**
Montana Best Management Practices (BMPs) that Address Slope Stability

| **Road Planning and Location** |
|---|
| Review available information and consult with professionals as necessary to help identify erodible soils and unstable areas, and to locate appropriate road surface materials. (BMP I.A.2.) |
| Locate roads on stable geology, including well-drained soils and rock formations that tend to dip into the slope. Avoid slumps and slide-prone areas characterized by steep slopes, highly weathered bedrock, clay beds, concave slopes, hummocky topography, and rock layers that dip parallel to the slope. Avoid wet areas, including moisture-laden or unstable toe slopes, swamps, wet meadows, and natural drainage channels. (BMP I.A.4.) |
| **Road Design** |
| Design roads to balance cuts and fills or use full bench construction (no fill slope) where stable fill construction is not possible. (BMP I.B.3.) |
| **Road Construction** |
| Keep slope stabilization, erosion and sediment control work current with road construction. (BMP I.D.1.) |
| Stabilize erodible, exposed soils by seeding, compacting, riprapping, benching, mulching, or other suitable means. (BMP (I.D.2) |
| Minimize earth-moving activities when soils appear excessively wet. Do not disturb roadside vegetation more than necessary to maintain slope stability and to serve traffic needs. (BMP I.D.4.) |
| Construct cut and fill slopes at stable angles to prevent sloughing and other subsequent erosion. (BMP I.D.5.) |
| Avoid incorporating potentially unstable woody debris in the fill portion of the road prism. Where possible, leave existing rooted trees or shrubs at the toe of the fill slope to stabilize the fill. (BMP I.D.6.) |
| **Road Maintenance** |
| Avoid cutting the toe of cut slopes when grading roads or pulling ditches. (BMP I.E.3.) |
| Haul all excess material removed by maintenance operations to safe disposal sites and stabilize these sites to prevent erosion. Avoid side-casting material into streams or locations where erosion will carry materials into a stream. (BMP I.E.5.) |
| **Timber Harvesting** |
| Locate skid trails to avoid concentrating runoff and provide breaks in grade. Locate skid trails and landings away from natural drainage systems and divert runoff to stable areas. Limit the grade of constructed skid trails on geologically unstable, saturated, highly erosive, or easily compacted soils to a maximum of 30 percent. Use mitigating measures, such as water bars and grass seeding, to reduce erosion on skid trails. (BMP II.A.5.) |

Note: In addition to these road and harvest BMPs, there are many additional rules that indirectly address management-related slope stability concerns through rules that require drainage structures and water management on roads and skid trails.

## Summary of Road and Upland Commitments

The road and upland management commitments under the NFHCP are organized into the following three categories, recognizing that there may be some crossover between categories.

**A. BMPs Governing Active Forest Practices:** Basic regulations and BMPs in place today generally do a good job of minimizing impacts from upland forestry and road-related activities. There are two NFHCP commitments in this category. The first is a commitment to implement Montana's voluntary BMPs as if they were required by regulation. The second describes enhanced standards for new road construction above and beyond basic regulations.

**B. Management and Upgrade of Transportation System:** The management system an organization uses to manage a forest road system can increase conservation effectiveness, yet is not easily regulated. Similarly, mitigation of impacts associated with roads constructed prior to any conservation standards, perhaps even when others owned the property, are difficult to accomplish through a regulatory structure. The seven commitments in this category represent good opportunities for effective conservation that work well within an HCP. These include inspecting and upgrading the road system to reduce sediment delivery to streams and abandoning portions of the system surplus to Plum Creek's long-term forest management needs.

**Definitions**

A **road** is a part of the permanent transportation system for use by log trucks and administrative vehicles that is recorded in Plum Creek's GIS road database. A **temporary road** is a road constructed to minimal transportation standards and abandoned within the same year and therefore is not added to, or removed from, the road database. These roads cannot be tracked for BMP status.

A **skid trail** is not a road. It is used by ground-based skidding equipment and causes minimal disturbance. A skid trail is treated immediately following use with BMP erosion control measures. Similar to a temporary road, it is used and then essentially abandoned in the same year.

A **constructed skid trail** is a skid trail that is constructed before skidding to facilitate ground-based skidding. The construction constitutes a cut-and-fill cross-section similar to a road, but is much more narrow, and constructed to a much lower standard. Normally, only a small percentage of skid trails are constructed skid trails.

**C. Other Measures:** The three commitments in this category represent additional opportunities for meaningful conservation contributions related to roads, including reducing public access to roads near known poaching areas, assessing landslides in the Papoose Creek watershed, and other judicious road restrictions.

Additionally, Plum Creek will initiate research on the effectiveness of the NFHCP road BMPs. A Core Adaptive Management Project (CAMP) is proposed in AM1, the *Effectiveness Monitoring* commitment, and will validate sediment delivery models, examine downslope sediment travel distances below road drainage features, and track sediment delivery from Project Area roads through time (see CAMP1 in Appendix AM-1). Basic research will also be undertaken as part of CAMP1 in several watersheds to examine how NFHCP sediment reduction measures are translating into improved fish habitat. Results from

these studies can be used to update the NFHCP over time (see NFHCP Section 8, Adaptive Management).

## *A. BMPs Governing Active Forest Practices*

BMPs are practices adopted by states to minimize water quality impacts associated with current and active forest practices. BMPs are intended to comply with the federal Clean Water Act (CWA) by managing non-point source pollution. The CWA requires states to adopt practices that protect beneficial uses of streams. One of those beneficial uses is the use of streams by fish. Reference to the term "BMPs" includes the non-regulatory BMPs in Montana as well as mandatory rules of Idaho and Washington, which are essentially BMPs for water quality codified under the states' respective Forest Practices Acts (FPAs). The term "Best Management Practice" is derived from the CWA for conservation measures that protect water quality. The use of this term does not imply that there is no way to improve upon them. The purpose of the following commitments is to minimize the impacts of current road-related activities and other upland management.

Plum Creek's third environmental principle says Plum Creek will "meet or exceed state and federal standards by employing Best Management Practices for protection of water quality and aquatic resources" (see Section 1, page 1-13, of this NFHCP). The first commitment in this category primarily speaks to **meeting BMPs** as a conservation foundation for the remaining commitments. The second addresses specific ways in which we commit to **exceed BMPs** when constructing new roads. Other road management practices are addressed in Sections B and C of this section.

**R1: BMP Compliance**

Plum Creek will maintain its level of compliance with FPA Rules and Forestry BMPs (in effect when Permit is issued) covering roads and upland forest management activities in each of the three states within the Project Area. In Montana, BMPs are a non-regulatory program. Plum Creek's commitment, then, is to comply with the Montana BMPs as if they were State law. In Washington state, certain detailed provisions of the Forest Practices Act do not apply to entities that have approved Habitat Conservation Plans with substantive provisions for those activities. Appendix Rp-6 summarizes which aspects of the Washington FPA will apply to Plum Creek directly and which aspects will be met by the provisions of the NFHCP.

***Rationale:***

Meeting state forestry statutes and rules is a baseline requirement for holders of all HCPs. However, to date, the BMP program in Montana has not been incorporated into a regulatory framework (except for the streamside management rules, discussed in the next section). Though statewide performance of BMPs is audited by the state to verify Montana's compliance with the federal CWA, some criticism has been raised that implementation of BMPs is "voluntary" and therefore provides uncertain conservation. This commitment removes the uncertainty on Plum Creek lands by requiring implementation of the Montana BMPs.

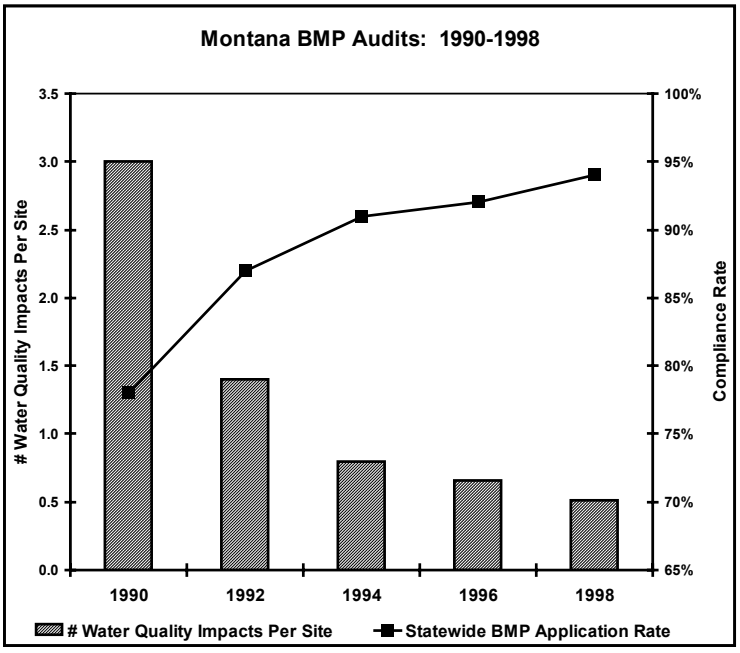


**Figure NFHCP2-1**

The BMPs in each of the three states are conservation measures employed by the states to preserve water quality. Plum Creek Technical Report #3, *Surface erosion and mass wasting assessment and management strategies for Plum Creek's NFHCP*, discusses the important role played by these measures in minimizing sediment delivery from upland forest management activities. Technical Report #6, *Summary of regulatory and voluntary programs for protecting bull trout on forestlands within Plum Creek's aquatic Habitat Conservation Planning area* (Plum Creek 1997a) demonstrates how the BMPs of the states fall within a wider umbrella of conservation. These state-directed conservation measures provide the important foundation for the commitments that follow (R2 through R11).

Under commitment R1, *BMP Compliance*, Plum Creek will maintain its compliance with all BMPs, including those related to road location, construction, and maintenance; and timber harvesting, log skidding, site preparation, reforestation, stream crossings, and other upland management activities. BMPs also focus on harvesting in riparian areas, but these will be discussed and referred to separately in the riparian management section.

The state of Montana has conducted biennial audits of BMP compliance since 1990, the year after BMPs were formally adopted in Montana (Schultz 1990, 1992; Frank 1994; Matheius 1996; Fortunate et al. 1998). These audits have documented the dramatic increase in BMP application over this time period. In 1990, the statewide BMP application rate was 78 percent. In 1998, statewide compliance averaged 94 percent. Commensurate with this improvement in compliance, the average number of water quality impacts per site has decreased 83 percent (see Figure NFHCP2-1). Since 1994, Plum Creek compliance has greatly exceeded the state average (averaging 97 percent since 1994). Recognizing that incidental deviations from BMPs will occur from time to time despite best efforts to avoid them, such deviations will not cause Plum Creek to be out of compliance with the NFHCP. BMP compliance will be monitored under NFHCP commitment A6, and deviations from compliance that are too large will trigger mandatory action planning to improve compliance under NFHCP commitment AM2.

**R2: New Road Construction**

Plum Creek will design and construct new roads to "enhanced" BMP standards. This means that Plum Creek will not only meet existing state rules and BMPs, but will exceed them by implementing certain enhancements. These enhancements are described in detail in Appendix R-1, but are summarized as follows:

1. Where road grades slope toward stream crossings, Plum Creek will install driveable drain dips and/or ditch relief pipes at the nearest practicable location to streams with an adequate filtration zone in order to minimize sediment delivery to streams.

2. Road fills over stream crossings will be grass seeded and straw-mulched concurrent with construction. Other road cuts and fills on newly constructed roads will be seeded within one operating season. The tread on native-surface roads will also be grass seeded within one operating season following construction unless the road will be used for hauling within 2 years of construction.

3. Slash filter windrows or a suitable alternative will be installed at the toe of all fillslopes that are within 50 feet of streams.

4. Fills at culvert inlets on stream crossings (culverts greater than or equal to 24-inch-diameter) will be well-armored with rock.

5. Stream crossing culvert installations in Idaho and Montana will be designed to accommodate at least the 50-year peak flood as determined by U.S. Geological Survey flood magnitude prediction procedures (as an alternative, the culvert size for a 50-year flood may be calculated by a Plum Creek hydrologist based on an analysis of channel dimensions). In Washington state, hydraulic regulations presently require sizing to accommodate at least the 100-year flood. This will be met as a minimum standard in Washington.

6. Where roads are located on highly erodible soils (as defined in Appendix R-1), the road tread over stream crossings will be rocked. Maps will be provided to foresters to aid in determining where these soils exist.

7. New roads that are proposed on sideslopes greater than 70 percent will require a review for potentially unstable features. These include bedrock hollows, inner gorges, convergent headwalls and toes of deep-seated landslides (see Appendix R-8 for descriptions of these landforms). If potentially unstable features are identified where sideslopes exceed 70 percent, an attempt will be made to find a suitable alternative location. Where that is not feasible, a report will be prepared by a geotechnical specialist that evaluates risks of landslides on this segment of road and recommends ways to minimize risks.

8. Road cross-drainage will be provided as frequently as necessary to control road tread erosion. On active native-surfaced roads, road drainage features will be located such that road runoff distances generally do not exceed 300 feet (and will not exceed 400 feet) along the road centerline. On highly erodible soil types, or on road grades steeper than 8 percent, this spacing will be reduced from the specifications listed above.

9. Road clearing limits will be minimized where roads cross streams.

10. Where seeps or springs are discovered during road construction, drainage features will be installed that pass accumulated surface water across the road prism and return it to the forest floor as close to the point of origin as reasonably practicable.

11. Roads located in Channel Migration Zones (CMZs) will be constructed with minimum fill depths, and include drainage features at all active channels.

12. Stream crossing culvert installations must be designed to accommodate fish passage on fish-bearing streams (See Appendix R-6).

For each new mile of road Plum Creek constructs in a Planning Area Basin, at least 2 miles of existing road in that Planning Area Basin will be upgraded (see R5) or abandoned (see R7) prior to, or concurrent with, new construction. This requirement will no longer apply after all Project Area roads have been upgraded in a given Planning Area Basin. This "pay-as-you-go" provision will be monitored annually for the first 10 years of the plan as part of NFHCP Administration and Implementation (See A6 in HCP Section 7).

The enhanced BMPs for new roads may be improved during the term of the NFHCP to better meet the NFHCP goals as a result of a mandatory collaborative management response, triggered by a failure to meet NFHCP biological goals. They may also be adapted as the result of a cooperative management response. See NFHCP Section 8.

***Rationale:***

Most road miles of new roads required within the Project Area will be constructed within the first decade of the NFHCP with a smaller amount being more or less evenly spread through-out the life of the plan as new opportunities to improve road systems are discovered or as immature stands become ready for harvest. New road construction has perhaps the greatest potential of any forest activity to produce sediment that could be delivered to streams. Risk of sediment delivery generally is the greatest in the first years following construction. State BMPs for new road construction, such as routing road runoff through filtration zones, has been shown to dramatically reduce this risk (Plum Creek 1998a). Plum Creek's use of enhanced BMPs will reduce risks of sediment delivery even further.

What is an enhanced BMP? BMPs written for states tend to be generalized, allowing for flexibility in interpretation and application. When creating rules that apply to a wide range of landowners over a broad geographic area, this flexibility allows landowners and regulatory personnel the necessary and beneficial leeway to apply BMPs in specific ways depending upon the circumstance. Under an HCP, a landowner has the opportunity to be more specific to give the Services a greater level of confidence the BMPs will actually minimize the risk of impacts associated with various activities. BMPs can be enhanced in several different ways. First, they can be written to provide greater clarity of intent or specificity with regard to implementation. Secondly, a state BMP that is written and intended as an optional manage-ment tool can be supplemented with a more specific commitment. For instance, a commit-ment can be made to use the conservation tool every time a certain situation occurs. Third, an enhancement may add rigor to the BMP in cases where it is believed greater conservation can be obtained effectively and efficiently. Lastly, the enhancement can describe specific physical factors that warrant extra protection.

Of the 12 enhanced BMPs for New Roads listed above, seven address BMPs that were identified in the 1998 Montana BMP Audit as most often out-of-compliance (Fortunate et al. 1998). These include providing adequate road surface drainage, routing road drainage through adequate filtration zones, directing road drainage away from stream crossing sites, stabilizing erodible fills, properly sizing crossing structures, and avoiding high hazard areas. The enhanced BMPs will provide the necessary specificity to ensure that these "problem BMPs" are fully addressed on new roads. For the specific rationale for each BMP enhancement, see Appendix R-1.

Under the NFHCP, the reduction in sediment delivery to streams from the existing road system is expected to greatly exceed the increase in sediment delivery to streams from new road construction (see EIS Section 4.2, *Geology and Soils*). To ensure that a net reduction in sediment delivery occurs from the outset of the NFHCP, a "pay-as-you-go" provision is included in R2. The 2:1 ratio between upgrading/abandonment and new road construction is based on a desire to ensure that sediment reductions exceed any increases in sediment delivery throughout the first decade of the NFHCP in each Planning Area Basin.

## *B. Management and Upgrade of Transportation System*

FPA rules and BMPs generally apply only to active projects and do not prescribe specific actions on old roads unless they are part of a new or active project. There are many miles of old roads in the Project Area constructed before contemporary BMP/FPA standards. More than half of the Project Area includes properties purchased by Plum Creek within the past 6 years. These parcels contain a large number of miles of these older roads. Plum Creek's commitment to redesign and reconstruct old roads to current standards is an opportunity to voluntarily mitigate for the effects of past activities.

Commitments R3 through R9 deal with the management of the existing road system to reduce and prevent sediment delivery.

**R3: Road Condition Tracking**

Plum Creek commits to tracking the status of road conditions in the Project Area. This will be done using a road database layer that quantifies BMP status of Project Area road segments. The roads in the database designated with a BMP status are those for which Plum Creek has complete or shared management responsibility. They include private access roads off Plum Creek land that Plum Creek uses and manages, such as federally cost-shared roads. BMP status will not be recorded for publicly owned roads (such as county or state roads) or access roads for which Plum Creek has rights for use, but no management control or authority.

The BMP status layer will be an updateable geographic information system. It will show the road network spatially and facilitate estimation of road miles by BMP status. A BMP status designation will be assigned for each entire road segment. BMP status designations are as follows:

- **In Compliance:** Road segment has been field-inspected and has been determined to fully meet either Plum Creek's NFHCP enhanced BMPs for new roads (R2) or for old road upgrades (R5).

- **Out of Compliance:** Road segment has been field-inspected and has been found to contain one or more locations not in compliance with enhanced BMP standards for new roads or old road upgrades. Work required to bring the segment up to current BMP standards involves typical upgrades (see R5, *Upgrade of Old Roads*; e.g., driveable drain dips, additional ditch relief pipes, waterbarring, etc.). The water quality impact associated with the current conditions is perceived to be minor to moderate. In situations where an old road does not meet the drainage spacing criteria in R5, but is well vegetated and showing no evidence of erosion, in can be considered as "in compliance."

- **Hot Spot:** These segments are a subset of the "Out of Compliance" designation and are designated as such so that treatment can be prioritized according to the severity of the problem and more rapidly than the road upgrade targets. A road segment (or a portion of a road segment) is found to contain one or more locations that have more complicated solutions, have a much higher water quality impact, or are more costly to address than standard BMP improvements. Criteria for designation of Hot Spots are described in commitment R6 and in the road condition inspection protocol (See R4). When a road segment is designated on the database as a Hot Spot, a written description and action plan will be prepared and placed on file at the local Plum Creek field office.

- **Not Verified:** Road segment has not yet been field surveyed.

The designation of BMP status for inclusion in the database would be field verified (see commitment R4, *Road Condition Inspections*, and R9, *Road Sediment Delivery Analyses*). The database layer for BMP status would be operational within six months of the issuance of the ITP, and would be updated annually. The timeframe for conducting road condition inspections is discussed in R4. Plum Creek began inspecting roads and building the road tracking database in 1997 based upon existing state BMPs. As BMPs are adapted or further enhanced over time, new BMPs will apply to new inspections and reinspections but will not render earlier inspections obsolete.

***Rationale:***

This commitment is integrated with other road management commitments with the intent of progressively reducing road-related effects and potential effects on aquatic and riparian habitats. The ability to record BMP status in the road database provides Plum Creek with inventory and tracking tools for road management that are not required under state regulations for land management.

This information and management tool has six major benefits for implementing the conservation commitments and improving the overall effectiveness of the NFHCP:

**Geographic Information System**

Plum Creek has a Geographic Information System (GIS) that contains the location of all company roads. The basis for the road layer was 1993-1994 aerial and ortho photography that was interpreted in 1995. Since 1995, foresters have annually updated the road information, adding new roads that had been constructed and refining the original data where necessary.

The GIS also contains attribute data for the road layer. Attribute information includes a road segment's BMP status, closure status, and whether the road has been identified as surplus or has been abandoned.

1. It provides centralized tracking of current road network conditions and creates an institutional memory, avoiding reliance on anecdotal information and the perception of individuals.

2. The persistence of "phantom" roads (for example, existing roads that are not recorded in the road database) and their potential effects on aquatic habitats would be minimized once the roads are inventoried.

3. Road reconstruction and regular road maintenance activities can be planned, budgeted, and administered by using an orderly record of road inspections that quantifies tasks and provides a visual spatial reference.

4. Consistent road condition data would allow Plum Creek to form action plans and prioritize projects.

5. Databases would be used for tracking the progress of conservation and monitoring NFHCP implementation.

6. The GIS map format of the databases would improve the communication and direction of action plans for road upgrades, Hot Spot repairs, and maintenance.

**R4: Road Condition Inspections (RCIs)**

Plum Creek will inspect roads to determine their BMP status and condition. Plum Creek foresters will perform the road inspections, and results will be included in the annual update of the road database. Outside experts may also submit observations or knowledge of possible road problems to Plum Creek for inspection and possible inclusion in the road database. Phantom roads discovered during the inspection process will be identified, mapped, inspected, and added to the database. Surplus roads (see R7, *Abandonment of Surplus Roads*) will be identified at this time as well.

RCIs will be performed by using the RCI checklist developed by Plum Creek in conjunction with routine forestry activities. Additional RCIs will also be conducted so that the entire road system in the Project Area will have been inspected by the end of year five of the NFHCP.

Where road problems are identified on jointly managed roads or are observed on adjacent lands, information will be communicated so that other landowners can participate in road system improvement.

The checklist will contain the enhanced BMP specifications for new roads and for old road upgrades. The RCI checklist (See Appendix R-2) will be incorporated in the NFHCP Field Implementation Manual. The RCI will determine the BMP status for a road segment (In Compliance, Out of Compliance, Hot Spot; and will also identify roads which are potentially surplus (see R7, *Abandonment of Surplus Roads*). At this time Hot Spots will require further consideration (see R6, *Hot Spot Treatments*)

***Rationale:***

State regulations do not require a specific road condition inspection program. Therefore, this commitment would provide assurance that current road condition information is recorded and made available for road management decisions. It is intended to institute a standardized process for assessing the relative risk that roads pose to native fish (road condition risk assessment).

The RCIs have several major benefits for implementing the fish conservation measures and HCP effectiveness:

1. Inspections would characterize existing road conditions and identify site-specific opportunities within the context of Plum Creek's land management program.

2. Results of the RCIs would be used to prepare action plans for upgrading roads to meet BMPs or to rehabilitate or repair road features and facilities through a deliberate maintenance program.

3. Prioritizing roads for their potential impact on fish would assure the most significant conservation benefits would be achieved first. Inspections would emphasize watersheds known to support bull trout, but would not be limited to those watersheds. Watersheds supporting other listed fish or with water quality limitations would receive priority treatment as appropriate. Therefore, a stronger tie would be established between the federal ESA and the Clean Water Act.

4. The schedule for inspections provides a deliberate regime for the preparation and implementation of site-specific management plans and timetables, including historic road system "Hot Spot" repairs.

5. Periodic maintenance would be regularly scheduled to manage road conditions proactively and anticipate normal design wear of facilities and structures that otherwise meet BMP standards.

6. Plum Creek would not rely on state or external BMP audits to assure compliance, but would proactively enact its own road inspection program.

RCIs are intended to inventory the backlog of pre-BMP roads for upgrade planning and implementation. Subsequent periodic inspections of upgraded roads for maintenance needs are addressed in R8, *Periodic Re-Inspection and Maintenance*.

**R5: Upgrade of Old Roads**

Plum Creek will upgrade old roads that have been determined in R4 to be "out of compliance" to enhanced BMP standards, including roads for which the company has or shares management responsibility. This means that old roads will not only be upgraded to meet existing state rules and BMPs but will exceed them by implementing certain enhancements. These enhancements are summarized at the end of this box but described in detail in Appendix R-3. Two priority categories are established for the purpose of focusing conservation:

- All roads in **high priority** watersheds will be upgraded by the end of 2010.
- All roads in the remainder of the Project Area will be upgraded by the end of 2015.

The high priority watersheds are more greatly impacted due to sediment delivery from roads and will be selected based on several criteria. High-priority watersheds will be identified within 2 months of the start of NFHCP implementation. The final list will be identified based on mutual agreement between Plum Creek and the Services, but will not exceed 20 percent of Project Area roads. The criteria are as follows:

- Native Fish Assemblages (as defined in Section 8, Commitment AM4)

- Watersheds that are considered impaired due to fine sediment delivery to streams based on the following data sources:
  - Water Quality Limited streams for sediment listed under section 303(d) of the Clean Water Act
  - State fish management agency data
  - Other available data

- Watersheds in granitic geologies

Per the criteria listed above, the following watersheds have already been determined to be a high priority for upgrading: Papoose Creek (tributary to the Lochsa River); Western Washington outliers (those lands in Western Washington falling outside of planning area basins); Ahtanum Creek (Middle and North Forks); Crooked Fork (above Brushy Fork, including Shotgun Creek, Lochsa River); Upper Brushy Creek (Lochsa River); Elk Creek (Swan River); Fishtrap Creek above the confluence of Jungle Creek (Thompson River); Keeler Creek (Lower Kootenai); North Fork Blackfoot River, Quartz Creek (Middle Kootenai); Vermillion River, (Lower Clark Fork); and Pine Creek (Lewis River).

Upgrading of remaining watersheds will be generally prioritized based on the following conservation guidance:

- Tier 1 watersheds
- Watersheds important to specific covered species
- Watersheds with higher road densities

Plum Creek will incorporate the requests of cost-share road partners in road upgrades per this commitment. Furthermore, Plum Creek will seek participation under existing cost-share agreements to achieve targets set forth under this commitment. Deadlines listed above can be extended where necessary to cooperate with adjacent landowners that share responsibility for a given road segment.

Where the water quality impact of upgrading an old road would exceed the conservation benefit, upgrading may be postponed until the road is needed for forest management activities. These roads will not be included in the normal upgrade schedule. Annual progress will be measured using the BMP status layer in the road database.

BMP enhancements and clarifications for old road upgrades are described in detail in Appendix R-3, but are summarized as follows:

1. Where road grades slope toward stream crossings, driveable drain dips and/or ditch relief pipes will be located at the nearest practicable location to streams with an adequate filtration zone in

order to minimize sediment delivery to streams.

2. Road cross-drainage will be provided as frequently as necessary to control road tread erosion. On active native-surfaced roads, road drainage features will be located such that road runoff distances generally do not exceed 300 feet (and will not exceed 400 feet) along the road centerline. On highly erodible soil types, or on road grades steeper than 8 percent, this spacing will be reduced from the specifications listed above.

3. Where existing stream crossing culverts have fulfilled their design life (or been washed out) in Montana or Idaho, replacements will be designed to carry the 50-year peak flood as determined by U.S. Geological Survey flood magnitude prediction procedures (as an alternative, the culvert size for a 50-year flood may be calculated by a Plum Creek hydrologist based on an analysis of channel dimensions) In Washington, stream crossing culvert replacements will be sized to accommodate at least the 100-year flood, per existing hydraulic regulations.

4. When the outlet of road drainage features are too close to streams for effective forest-floor filtration, supplemental sediment filtration will be provided (such as slash filter windrows, straw-bales, silt fences, etc.) and/or drainage feature spacing will be decreased to minimize sediment delivery. Where this cannot be effectively done, the road segment will be re-categorized as a Hot Spot under NFHCP Commitment R6, *Hot Spot Treatments*.

5. For stream-adjacent/parallel roads or where there is a high density of stream crossings, simple/inexpensive re-location will be utilized in addition to (or in lieu of) road drainage improvements where possible. When inexpensive re-location is not possible and drainage improvements will not greatly reduce sedimentation impacts, the road segment will be categorized as a Hot Spot and addressed under NFHCP Commitment R6.

6. Where upgrading or road use exposes bare mineral soil, disturbed areas will be grass seeded during appropriate soil moisture conditions before the end of the current operating season.

The enhanced BMPs for road upgrades may be improved during the NFHCP to better meet the NFHCP goals as a result of a mandatory collaborative management response, triggered by a failure to meet NFHCP biological goals. They may also be adapted as the result of a cooperative management response. See NFHCP Section 8.

***Rationale:***

Roads constructed prior to BMP standards are one of the most pervasive impacts to water quality on Plum Creek's ownership. This was recognized in 1994, when Plum Creek pledged to the Montana Bull Trout Restoration Team to upgrade old roads in bull trout watersheds. The NFHCP formalizes this commitment and expands it to all watersheds and includes an explicit schedule for accomplishment. The completion of the road database will enable Plum Creek to determine how much the company has completed and will be a tool in tracking annual progress.

To efficiently focus near-term financial resources, two categories were established to prioritize upgrading efforts. Plum Creek and the Services will identify a network of "high priority" watersheds in the first two months of the NFHCP. The criteria for selection ensure

that watersheds with the highest native fish values are upgraded first, along with those that may be most impacted due to sediment delivery.

McGreer et al. (Plum Creek 1998a) found that adding drainage where roads slope toward streams resulted in reductions in sediment delivery to streams by 25 to 85 percent (exclusive of other upgrade BMPs and most Hot Spot treatments). These BMPs also address the numerous problem BMPs described by Fortunate et al. (1998) on the Montana BMP audits. These enhancements, in concert with R6, *Hot Spot Treatments*, are expected to substantially reduce sediment delivery from old roads. The specific rationale for each enhancement is provided in the Appendix R-3.

**R6: Hot Spot Treatments**

In conjunction with R4, *Road Condition Inspections,* R9, *Road Sediment Delivery Analyses*, and R2, *Road Condition Tracking*, Plum Creek will identify legacy road system "Hot Spots" and develop and implement a site specific management plan for each. Hot spots will be identified by the end of year 5 under road inspection commitment R4. The management plan will provide for an accelerated time frame for completion compared to upgrade commitment R5. A "legacy road" is one that has lingering negative effects from past management activities. A Hot Spot Action Planning Form is provided in Appendix R-4 to guide foresters in Hot Spot management plan development. For Hot Spots designated on the road condition database, a Hot Spot written description and action plan will be on file at the local Plum Creek field office.

Hot Spots are generally characterized as situations where the risk of waiting for routine BMP upgrades is unacceptable or standard technical solutions outlined in R5, *Upgrade of Old Roads* would inadequately address the hazard. The following conditions will be designated as Hot Spots:

- Fish passage barriers (See Appendix R-6). Fish passage barriers that benefit native fish will not be considered hot spots.
- Roads located where impacts cannot be remedied by implementation of procedures outlined in R5, *Upgrade of Old Roads.*
- Erosion gullies more than 6 inches deep in road surfaces that lead directly to streams.
- Perched road fills that are at imminent risk of landsliding.
- Stream crossing culverts that are too short and are leading to fillslope instability and sediment delivery to streams.
- Washed-out culverts.
- Any other situation where forester common sense dictates a Hot Spot designation is warranted.
- Hot Spots may also include non-road-related problems related to forestry or harvest activities discovered through the normal course of business, such as sediment delivery to streams from skid trails and landslides (unless addressed under AM3, *Changed Circumstances*).

Foresters will consider whether a road with a Hot Spot should also be considered as surplus and targeted for abandonment as the preferred management action (see R7).

The intent of this commitment is to implement site-specific management plans for Hot Spots on an accelerated schedule. Exceptions may occur where complex legacy situations from past actions warrant an economic analysis and the seeking of partners to cost-share repairs (See Hot Spot Prioritization Guidance in Appendix R-5).

***Rationale:***

In many watersheds, Hot Spots will constitute the most severe impacts to water quality. In terms of sediment delivery, a handful of Hot Spots can contribute more sediment that the rest of the entire road system. For example, in the Goat Creek watershed in Montana's Swan Valley, five locations contributed 70 percent of road sediment delivery (See Technical Report #5 *Goat Creek and Piper Creek Watershed Analysis*, Plum Creek 1996a). In Boiling Springs Creek, also in Montana, three locations contributed 30 percent of the road sediment delivery (See Technical Report #11, *Thompson River Basin Watershed Analysis*, Plum Creek 1998d).

The exact nature and number of Hot Spots will not be known until after road condition inspections have been completed. It is expected that Hot Spots will be most often associated with roads constructed before BMP standards and include problems such as roads adjacent to streams, roads in unstable areas, and culverts that were not designed to accommodate fish passage. Correcting these types of problems is often expensive. As such, prioritizing Hot Spots for treatment will be critical for success of the program.

**R7: Abandonment of Surplus Roads**

**Surplus** Roads will be identified through road condition inspections, Hot Spot management planning, and during the course of routine forestry activities. All surplus roads will be abandoned. Specifications that determine when a road may be considered abandoned are detailed in Appendix R-7.

Abandonment will be performed concurrently with the upgrade of adjacent road systems. If the road also has been identified as a Hot Spot, treatment will be accelerated as detailed in the specific Hot Spot Management Plan (R6) prepared for the Hot Spot. If the road has been identified as accessing a poaching area under R10, *Poaching Mitigation*, it will be abandoned within 2 years following its identification.

Surplus roads will be identified on the road database so that the abandonment task can be effectively managed. Plum Creek will report the number of miles of road abandoned annually and will be able to keep a record of the location of those abandoned roads so that they can be monitored to see if the desired results are being achieved.

***Rationale:***

Roads are an important tool that Plum Creek uses to conduct commercial forestry. They are a capital investment and an important component of the company's value. However, many roads have become obsolete because of changing forestry technology. Other roads may require more cost to maintain over time than their benefits warrant. For these kinds of roads, abandonment becomes a good conservation opportunity. The goal of abandonment is to place the road in a condition where adverse environmental impacts are eliminated or significantly

reduced and the need to perform routine inspections and maintenance on that road is eliminated.

**Surplus Road:** a road that Plum Creek determines is no longer useful for forest management.

**Abandoned Road**: a road that is permanently closed, stabilized and no longer passable by vehicles, and is not intended for future forest management use. The criteria by which a road is determined to be abandoned are shown in Appendix R-7, and will be in the NFHCP Field Implementation Manual.

Most of the candidates for abandonment are very old roads constructed well before BMPs for roads were developed, and many occur near stream and valley bottoms. While there may be some short-term impacts associated with abandonment activity, there is expected to be a significant long-term benefit associated with removing these roads from Plum Creek's transportation system. There are no accurate estimates of the number of roads that might be considered surplus and eventually abandoned. Through RCIs, it is expected a sound estimate of surplus roads will be available by 2005.

Sediment production from abandoned roads is significantly lower than from traveled roads. The Washington Forest Practices Board Manual (1995) assumes that abandoned roads produce 2 to 5 percent of the sediment that a lightly traveled forest road does, based on a variety of research conducted in the Pacific Northwest. Sediment production on heavily trafficked roads has been shown to be 130 times higher than for abandoned roads (Reid and Dunne 1984). Other studies that have examined sediment production from roads have shown that vegetative cover can reduce on-site erosion by more than 80 percent (Burroughs and King 1989; Luce and Black 1999).

**R8: Periodic Re-inspection and Maintenance**

Plum Creek commits to periodically re-inspecting roads that have been constructed to or upgraded to enhanced BMP standards and to perform any maintenance necessary to preserve BMP function. Re-inspection will occur on an as-needed basis with maximum re-inspection intervals as follows:

- In High Priority watersheds (see Commitment R5), the maximum road re-inspection interval will be 5 years.
- For all other Project Area roads, the maximum re-inspection interval will be 7 years.
- Exception: In all watersheds (regardless of priority) where all of the following conditions are met, the maximum re-inspection interval will be 10 years.
  - Road segment contains no stream crossings.
  - Road segment is physically closed to vehicular access.
- Aerial reconnaissance will be conducted following 25-year (or greater) flood events to identify new or unanticipated road maintenance needs. This topic is addressed in more detail in Section 8, Commitment AM3, *Changed Circumstances*.
- Sediment will not be directly discharged to streams during road maintenance activities.
- Maintenance activities will be conducted so that the road is not progressively widened over time or the integrity of the road standard is not otherwise diminished.

- When post harvest road maintenance is performed and log truck use of roads is not anticipated for 15 years or longer, roads will be "put to sleep" to minimize the need for repeated maintenance and reduce the risk to water quality while still allowing administrative use if necessary. This is a generally more rigorous application of BMPs and typically involves grass seeding, increased drainage frequency, and restricting access by gate or physical barrier.
  - Applies where Plum Creek has sole ownership and discretion over road use.

***Rationale:***

**Road maintenance** is the performance of work on a road to preserve or restore the design features the road was constructed or upgraded to, while **road upgrading** is actually reconstructing roads to a different set of design standards. Once old roads have been upgraded to new standards (R5) or new roads have been constructed to enhanced BMP standards (R2), they need to be periodically re-inspected and maintained to ensure they are still functioning to minimize the risk of sediment delivery to streams.

Failure to properly maintain roads can result in increased sediment delivery to streams as a result of rutting (Burroughs and King 1989). Lack of maintenance can also lead to culvert failure when brush or debris blocks the inlet. In addition, where road material is sidecast during maintenance activities, the road can become wider, thereby increasing the area subjected to surface erosion.

FPA rules and BMPs in Washington, Idaho, and Montana all recognize this need and require periodic road maintenance. Plum Creek's commitment is to exceed BMPs for road maintenance, thereby enhancing state rules in three ways:

1. Specifying maximum re-inspection intervals and committing to aerial reconnaissance increases the rigor of the BMP.

2. The commitment is performed as an element of a transportation management system that uses a road database to schedule road management needs. This eliminates the risk that maintenance needs are overlooked.

3. Clarifying how maintenance will be accomplished to minimize impacts in specific ways, including prohibiting sidecasting material directly into streams.

The commitment R8 requires that aerial reconnaissance be conducted after a 25-year flood event. This flood-event interval was chosen because culverts on old Plum Creek roads were designed for a 25-year flood event, so those old roads should be inspected from the air after that type of flood to locate flood-damaged areas. A significant portion of the Project Area has experienced floods exceeding the 25-year severity, and many of the old culverts were replaced with higher-standard culverts. Therefore, many road deficiency problems have already been corrected using standards exceeding 25-year flood event levels, which will help reduce the overall likelihood of future road problems from floods.

**R9: Road Sediment Delivery Analyses**

Plum Creek will perform road sediment delivery analyses (RSDAs) on select watersheds in the Planning Area. This technical approach to quantifying sediment delivery to streams is intended to support and inform the more extensive road condition inspections performed in R4.

Commitments include:

- Preparing RSDAs for three third or fourth order watersheds per year for the first 10 years of the NFHCP selecting among all watersheds. Plum Creek will select watersheds, with priority given to: 1) Tier 1 watersheds; 2) watersheds of concern for other covered species; 3) watersheds with highly erodible soil types; 4) watersheds with streams listed as impaired under the Clean Water Act; and 5) watersheds studied as part of the NFHCP Adaptive Management Plan (see Section 8). Based on the criteria listed above, the following watersheds have been pre-identified for completion of RSDA's in the first 5 years of the NFHCP: Western Washington outliers (those lands in Western Washington falling outside of planning area basins; counts as 1 RSDA, only on Plum Creek roads); South Fork Ahtanum; and Parachute Creek.

- Sharing results with adjacent landowners and encouraging them to develop BMP action plans.

- Provide information to foresters for updating the road database.

- Use RSDAs to determine if sediment delivery from roads is being effectively minimized, and inform the "continuous improvement" implementation monitoring portion of the adaptive management implementation framework (see AM-2).

- Use RSDAs as a basis for evaluating the in-stream response of reducing fine sediment delivery to streams under Core Adaptive Management Project #1 (see AM1, *Effectiveness Monitoring* and Appendix AM-1).

***Rationale:***

RSDAs are a highly technical approach to quantifying road sediment delivery to streams. Because of the complexity and cost of doing these analyses, they will be done in selected watersheds to balance the less technical approach of the RCI. The watersheds will be chosen because they are of particular importance to native fish, have characteristics that make them particularly sensitive to management activities, and/or are already under study for some other reason related to the NFHCP. The idea of RSDAs is to do them in enough watersheds to obtain quality feedback

**What is a Road Sediment Delivery Analysis?**

A road sediment delivery analysis (RSDA) quantifies the amount of sediment delivered to streams from roads. It can be done on a stand-alone basis or as part of a watershed sediment budget. The approach that Plum Creek has used for RSDAs is outlined in the Washington Watershed Analysis Manual (WFPB 1995).

An RSDA is a rigorous approach for quantifying the amount of sediment delivered to streams. It involves field-inventorying all roads that are near streams. Information obtained to develop the sediment delivery estimate includes the following:

- Soil/Geologic type
- Width of the road
- Traffic use
- Length of road draining to streams
- Vegetative condition of road

on the success of old road upgrades (R5) and new road construction (R2). RSDAs provide a seamless linkage between the RCIs conducted by foresters across the entire Project Area, requirements under the Clean Water Act (such as Total Maximum Daily Loads [TMDLs]), and the adaptive management process.

## C. Other Measures

**R10: Poaching Mitigation**

Plum Creek will work with state fish and game departments to develop a road management plan aimed to reduce bull trout and other native salmonid mortality resulting from poaching on or adjacent to Plum Creek land. This will be incorporated into the overall road management plans of each Plum Creek management unit.

- The plan will involve road vehicle access closures to eliminate easy access to historic and high risk poaching sites on or adjacent to Plum Creek land.
- The plan will create cooperative agreements with agencies to facilitate enforcement of poaching at these high-risk sites.
- Roads identified for closure will also be evaluated to see if they are also surplus. If they are, they will be abandoned in accordance with R7 within 2 years of identification.

***Rationale:***

Bull trout are especially vulnerable to poaching because they congregate in predictable locations as they migrate to spawning habitats in headwater streams. Their large size and aggressive behavior, combined with a society that has sought to eradicate the species for a century because it was not a favored game fish, has contributed to the vulnerability of bull trout as a poaching target (Long 1997). The poaching of bull trout was socially acceptable for several decades and became a traditional activity in some parts of the Planning Area, thereby contributing to local bull trout population declines.

**Woodward Creek**

Woodward Creek is a tributary to the Swan River in Montana. Bull trout redd counts in the lower south fork of Woodward Creek averaged about 1 redd (or spawning "nest") per year in the 1980s. In the mid-1990s Montana Department of Fish, Wildlife and Parks enforcement officers began patrolling this reach of Woodward Creek for poachers. Since that time, redd counts have averaged 10 to 15 redds per year. While law enforcement can be credited with this success, customized management (such as closure or abandonment) of specific Plum Creek roads to reduce poacher access could lead to similar outcomes.

While Plum Creek activities may not be responsible for these stressors, we are uniquely situated to participate in meaningful solutions that contribute to recovery. As Long (1997) states: "*The importance of cooperation between game wardens… and the general public to work hand in hand to prevent illegal harvest of bull trout will continue to increase….*"

**R11: Road Restrictions**

Plum Creek is committed to using road restrictions to minimize impacts on the road system that may affect native fish populations. The following two approaches will be taken:

1. Public vehicular use on newly constructed roads will be restricted unless agreements with neighboring landowners require the road be kept open. Where restricting access on new roads is not practicable, the Services will be notified.

2. Plum Creek will use road restrictions on existing roads as a tool in minimizing sediment delivery in the Project Area. Road restrictions will be tracked using a road database layer that quantifies the restriction status of Project Area road segments similar to the tracking of BMP status in R3. Plum Creek will reserve the discretion to place the appropriate road restriction on existing roads using one of these four categories:

    - **Open**: no restrictions on road use.

    - **Closed**: road use restricted year-round to all motorized vehicles (except snowmobiles) by using a physical barrier.

    - **Restricted Year Round**: road is gated and use is restricted to authorized administrative use only.

    - **Restricted Seasonally**: road is gated and use is restricted for a portion of the year.

Road closures and restrictions programs will be established to balance public interests and the need to protect water and wildlife resources as well as Plum Creek's investment in its roads

***Rationale:***

Unrestricted use of an extensive road system by the public can lead to a wide variety of impacts to fish. Some of these are measurable, such as increased sediment risk associated with greater amounts of traffic, while others are less certain.

Motorized use of forest roads by the public is a traditional use of forest roads and is the leading form of outdoor recreation in the Northwest. Much of this use comes during fall and spring hunting seasons when roads are particularly vulnerable due to moist soils. When unrestricted road use leads to rutting, erosion rates can be doubled (Burroughs and King 1989). This is supported by other studies that have found that heavily trafficked roads produce substantially more erosion (Reid and Dunne 1984; Bilby et al. 1989), and require additional maintenance such as grading that can increase surface erosion rates as much as seven-fold (Luce and Black 1999) while increasing road maintenance costs and activities.

Because the use of these roads is important to the public, judicious and well-planned road restrictions are important in balancing resource needs with public desires. Plum Creek's commitment to using a road restriction layer in the road database will improve its ability to make sound decisions about road management.

**R12: Papoose Creek Landslide Assessment**

In the Papoose Creek watershed (tributary to the Lochsa River, Idaho), Plum Creek will prepare an analysis of landslides and landslide risks on Project Area lands and a detailed management plan to reduce landslides by the end of 2001. This analysis and planning process will:

1. Identify the characteristics of existing landslides based on review of current and historic aerial photographs along with field reconnaissance. This review will generally follow protocol outlined in the Washington Watershed Analysis Methodology (WFPB 1997). This analysis will identify the location and character of all existing landslides on Project Area lands; associate these landslides with particular landforms; and identify the likely cause of the landslide (e.g., stream crossing failure, wood in fills, harvest/burn related, concentrated road drainage, natural, etc.). Additionally, as part of this analysis, a stream crossing inventory will be completed to evaluate potential for culvert failure. This inventory will include an examination of culvert capacities in relation to predicted flood flows (i.e., probability of failure) as well as the fill volume at risk of failure (i.e., and index of environmental consequence).

2. Based on the analysis above, potentially unstable features on Project Area lands in the watershed will be mapped. This will provide a basis for determining need for geotechnical review of any new roads.

3. Identify surplus roads (see R7).

4. Identify Hot Spots and prepare Hot Spot Action Plans (see R6).

5. And identify other voluntary road abandonment opportunities.

Restoration Action Plan—Based on the analysis above, a detailed restoration action plan will be prepared by Plum Creek and submitted to the Services for input by the end of 2001. Additionally, this plan will specify watershed-specific road construction and harvesting criteria.

This action plan will be implemented by the end of 2003.

***Rationale**:*

In response to public comment on the draft NFHCP, the NMFS identified landsliding as a specific concern in the Lochsa River Planning Area Basin. Upon inspection of available Forest Service landslide inventory data (McClelland et al. 1997) and after consultation with local Plum Creek foresters, the Papoose Creek watershed was identified as having the greatest risk to Permit species from landslides. The specific actions developed in Commitment R12 are intended to dovetail with analyses and actions on adjacent federal ownership. These actions include analyzing historic landsliding in the area, identifying where continued landslide risks exist due to Project Area management, and rapid implementation of a site-specific action plan to remediate past impacts and reduce future landslide risks.